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ABSTRACT

This unit examines questions about biodiversity and its preservation through six activities. Each activity allows students to explore a particular approach to preservation and to identify some of the challenges facing policymakers. Through the introductory activities and the six focused activities, students devélop an understanding of the dynamics that exist beneath the surface of preservation activities. The activities were chosen to encourage thinking about the balancing of different values in determining how best to promote biodiversity. The unit is designed primarily for teachers of biology, contemporary world issues, or environmental studies, grades 7-12. Each activity contains a teacher's section with background materials, extension questions to assist in debriefing, related issues for further research, an activity card, resource cards needed to complete the task, and an individual report to reinforce individual and group accountability. Activities of the unit include: (1) Orientation Activities; (2) "Species Preservation"; (3) "Regenerative Use"; (4) "Biosphere Reserves"; (5) "Ecotourism"; (6) "Public/Private Partnerships"; (7) "Public Policy"; and (8) "Developing a Plan for Preserving Biodiversity in Our Neighborhood." Two appendices conclude the unit: (1) a 14-item bibliography and (2) the 1992 Convention on Biological Diversity. (EH)

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ED 426 001

How Can Biodiversity Be Preserved?

A Curriculum Unit for Science and Social Studies
Grades 6-10

Developed by Jane Boston and Stephen Commins
Stanford Program on International and Cross-Cultural Education (SPICE)
Institute for International Studies

in cooperation with the

California International Studies Project
Stanford University School of Education

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Unit Introduction

How Can Biodiversity Be Preserved?

Rationale

Biologists and ecologists provide insights that allow us to understand the dynamics of the natural environment in new and complex ways. Their studies are challenging policy makers to devise strategies that can help preserve and sustain the diverse biological resources of our planet. The learnings about biological diversity provide new perspectives on the connections between apparently small changes and large shifts in our planet's ecosystems. As educators we attempt to provide information for our students, helping them to understand biological diversity and the difficult choices that face policy makers who seek to develop workable approaches to preserve our planet's resource base.

Biological diversity can be described or defined at a number of different levels of life. It can refer to genetic diversity, that is the variation between specific individuals and the overall population. It can refer to species diversity, the necessary interrelationships and differences between different species that occupy overlapping living space. Of equal importance, there is the matter of the overall life of a community or ecosystem, which can only survive through its diverse life forms, both plant and animal. Biological diversity is under pressure from a variety of sources, including the loss of habitat, disappearance of species and the spread of human settlements.

Biodiversity is a complex phenomenon, as it involves not only the natural environment, but human actions as they affect different environmental systems. Because human activity has developed various political, economic and social institutions that often attempt to reduce the risk from natural factors, the value or loss of biodiversity is not always apparent. Thus moving from the scientific studies to the realm of policies can create tensions and serious disagreements over the best courses of action. One of the goals of *How Can Biodiversity Be Preserved?* is to give students information and experience so that they can look beyond the headlines and gain insights into larger questions and issues.

How Can Biodiversity Be Preserved? looks at some of the questions about biodiversity and its preservation through six activities. Each activity allows students to explore a particular approach to preservation and to identify some of the challenges facing policy makers. Through their introductory activities and the six focused activities, students will develop an understanding of some of the dynamics that exist beneath the surface of preservation activities. The six activities were chosen because they illustrate significant issues from different perspectives. In addition,

one of the goals of the unit is to encourage thinking about the balancing of different values in determining how best to promote biodiversity.

Biodiversity requires thinking in ways beyond the protection of a single resource or region. *How Can Biodiversity Be Preserved?* offers an introduction to a complex and sometimes contentious subject. It does not attempt to provide illustrations of all facets of biodiversity preservation, nor does it attempt to answer all questions. The cases do offer the opportunity for students to be involved in a wide range of issues. With each case, students will explore a particular aspect of biodiversity preservation while they learn about the challenges of policy making.

Unit Goals

- to expand students' knowledge and understanding of some aspects of biodiversity
- to promote an understanding of the some of the options and issues involved when making decisions about the preservation of biodiversity
- to make connections between the students' own experiences with biodiverse resources and the unit

Unit Framework

This unit is designed primarily for teachers teaching biology, contemporary world issues, or environmental studies, Grades 7-12. These activities might be used as part of a more extensive study of biological diversity and the global environment.

Group Work

The pedagogical design of *How Can Biodiversity Be Preserved?* is based on many years of research in the Stanford School of Education by Dr. Elizabeth Cohen, and more recently Dr. Rachel Lotan, on how to increase student access to learning through group work. This research by The Program for Complex Instruction led to the development of a teaching approach and a model for curriculum materials. The teaching approach itself is a complex one and involves intensive staff development for full implementation. These materials are not designed to introduce that approach to the novice. They do, however, fit the model for curriculum materials and may be useful to teachers using the complex instruction approach. It is our hope that material developed in this way will also be useful to teachers using other cooperative, small group teaching strategies.

Group work units contain 6-8 activities organized around a big idea, central question, or major concept of a discipline. Students rotate through a series of group activities designed to stimulate thinking and discussion about the big idea. When students report the results of their investigations, the teacher needs to ask questions that probe the students' understanding, make connections among the different activities, and address the fundamental content of the unit.

At the heart of these curriculum materials are resource materials which draw heavily on primary sources and provide students with greater access to the academic content of the unit. When students examine photographs or listen to tapes in addition to textual material, they have increased access to the learning task. Even students who cannot read at grade level will participate more.

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Each activity includes a group project that is multi-dimensional and encourages the use of multi-media. These projects give more students the opportunity to contribute to the success of the group and demonstrate and be recognized for their own competence and understanding of the content. Increased participation is related to increased learning. These materials combine a group project which reinforces the students' interdependence and an individual report which holds students individually accountable.

An important feature of this curriculum model is the open-ended nature of the questions. Most questions do not have one right or wrong answer and the group products also depend on the group's decision. This design feature contributes to the development of higher-order thinking skills.

In *How Can Biodiversity Be Preserved?*, two activities at the beginning are included to set the stage for studying options for preserving the earth's biodiversity. In the first of two *Orientation Activities*, students identify and define the concept of biodiversity. In the second activity, they explore both its importance to the planet and the stresses currently being placed on many biological species throughout the world.

At the core of the unit are six activities that specifically address the big question by focusing on six different strategies currently being used in different locations throughout the world to preserve biodiversity. Each activity includes a section for the teacher with background on the strategy and the specific case studies. Also included are extension questions to assist the teacher in debriefing student presentations and a list of related issues to serve as further research or discussion items. Each activity also includes a set of cards for the students: an *Activity Card*, which includes background information, open-ended questions, and an interdependent task the group must complete; a set of *Resource Card(s)*, which are needed to complete the task; and an Individual Report, which serves to reinforce individual, as well as group, accountability and to give the teacher a measure of the student's understanding of the big idea.

At the end of the unit is the *Closure Activity* in which students will apply their analysis of the issues by surveying the biodiversity of their community and developing a plan to preserve and/or restore biodiversity.

Multiple Abilities

In order to ensure access to learning, multiple ability tasks are incorporated in each of the activities. The following is a list of some of the multiple abilities that the students will need to complete the various activities in this unit:

- Linguistic abilities
  - understanding how a text fits into the big picture
  - translating the message of the text into another form
  - identifying the main point of the text
  - identifying multiple points of view
  - explaining ideas clearly
  - developing and giving persuasive oral and written arguments
- Visual abilities

grasping the message of a picture
recognizing and using symbols
noting details in pictures
interpreting political cartoons
translating ideas into visual forms
interpreting graphs and charts

- Spatial abilities
  - interpreting schematic plans
  - translating ideas into layouts and schematic designs
  - translating ideas into three-dimensional models
- Interpersonal abilities
  - listening to and interpreting the ideas of others
  - clarifying perspectives and points of view
  - asking for help when needed
  - recognizing when help is needed by others and providing appropriate assistance
  - sharing resources and tools with others
  - working with others to complete a task
- Dramatic abilities
  - creating a dramatic sequence
  - expressing feelings, messages, and situations through acting

Reference Materials

Cohen, Elizabeth G. *Designing Groupwork: Strategies for the Heterogeneous Classroom*. New York: Teachers College Press, 1994 (rev. ed.).

World Resources Institute. *World Resources 1994-95: A Guide to the Environment*. New York: Oxford University Press, 1994.

Icons

For easier references the following icons are used throughout the unit:

Orientation Activity

THE CONCEPT OF BIODIVERSITY

Overview

The purpose of the *Orientation Activity* is to acquaint students with the concept of biodiversity and how it can be found in many different facets of life.

Objectives

- to define biodiversity
- to discuss the importance of biodiversity to the planet and how stresses on the earth's biological systems threaten it

Time

One class period

Materials

- Transparency 1: *The Species-Scape*
- Transparency 2: *Categories of Species That Are Classified*
- Transparency 3: *Species Remaining to be Described*
- Handout 1: *Levels of Biodiversity*
- Handout 2: *Key Words*
- Handout 3: *Key Words—Answer Sheet*

Suggested Procedure

1. Ask students to look around the classroom and identify as many things as possible that are products of plants and animals. Write their answers on the chalkboard or on butcher paper. Ask them what they think is meant by the term biodiversity. Record their answers on the chalkboard or butcher paper.

2. Ask students to work in pairs. Give each pair a piece of butcher paper and ask them to list or draw as many examples of the earth's biodiversity as they can during the next five minutes.

3. When the pairs have finished working, ask them to hang their butcher paper around the room. Ask them if they know what is meant by a biological species (a biological species is a group of related organisms capable of interbreeding freely under natural conditions). As a group, count the number of species on the students' lists.

4. Show Transparencies 1 and 2: *The Species-Scape* and *Categories of Species That Are Classified* to the students to review the estimated numbers of species currently known to science and included in the definition of biodiversity. Show Transparency 3: *Species Remaining to Be Described* to illustrate that most scientists believe that we have identified only a very small percentage of all the species on earth.

5. Tell the students that identifying the diversity of living organisms by their species is one way of describing the world's biodiversity. Explain that there are other ways as well. Some scientists work to define biological diversity through differences in the genes (DNA) of individual cells that may produce different characteristics among members of the same species (*genetic diversity*). Others look at whole systems and explore biological diversity through a study of *ecosystem diversity*.

6. Give each pair of students Handout 1, *Levels of Biodiversity*. Ask them to complete the chart by filling in examples of each level of biodiversity. Circulate through the room as they work on this activity and use the opportunity to correct misconceptions about appropriate placement of organisms and ecosystems on the chart. Ask the students to save their charts and continue to add examples throughout the unit.

7. Explain to the students that in each of the activities in this unit they will see some new words. Ask them to work together in groups of four to find definitions for these words.

8. Provide each group with one copy of Handout 2, *Key Words*. Ask the groups to define as many of these words as they can.

9. When the groups have finished, give them copies of Handout 2, *Answer Key*, and instruct them to compare their definitions with the *Answer Key*. Encourage the groups to have the *Answer Key* available when they begin the group activities. Also tell them that they should add other new words to this list as find them.

Reference Materials

Blair, Robert and Heidi Ballard. *Conservation Biology*. Stanford, CA: Stanford University, 1994.

Wilson, E. O., Editor. *Biodiversity*. Washington, D.C.: National Academy Press, 1988.

Wilson, E. O. *The Diversity of Life*. New York: W. W. Norton and Company, 1992.

World Resources Institute. *Teacher's Guide to World Resources, 1992-93*. New York: Oxford University Press, 1992.

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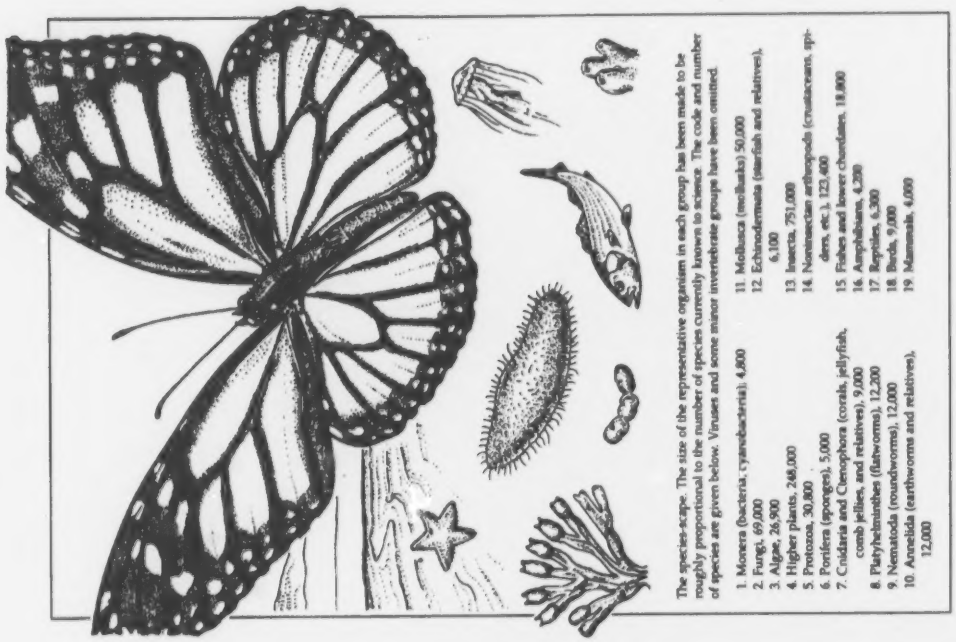
THE SPECIES-SCAPE



The species-scape. The size of the representative organism in each group has been made to be roughly proportional to the number of species currently known to science. The code and number of species are given below. Viruses and some minor invertebrate groups have been omitted.

1. Monera (bacteria, cyanobacteria), 4,800
2. Fungi, 69,000
3. Algae, 26,900
4. Higher plants, 248,000
5. Protozoa, 30,800
6. Porifera (sponges), 5,000
7. Cnidaria and Ctenophora (corals, jellyfish, comb jellies, and relatives), 9,000
8. Platyhelminthes (flatworms), 12,200
9. Nematoda (roundworms), 12,000
10. Annelida (earthworms and relatives), 12,000
11. Mollusca (mollusks) 50,000
12. Echinodermata (starfish and relatives), 6,100
13. Insecta, 751,000
14. Noninsectan arthropods (crustaceans, spiders, etc.), 123,400
15. Fishes and lower chordates, 18,000
16. Amphibians, 4,200
17. Reptiles, 6,300
18. Birds, 9,000
19. Mammals, 4,000

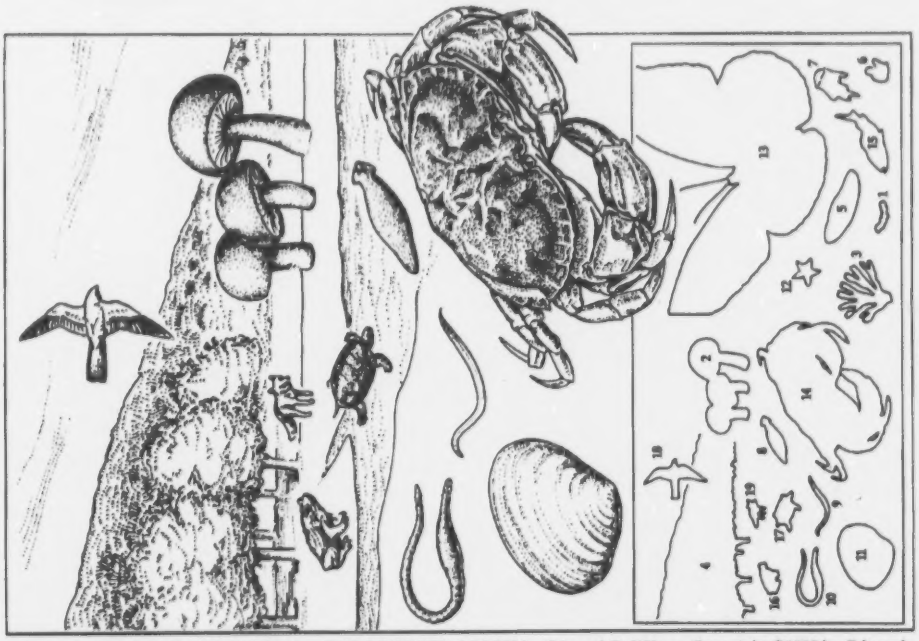


Illustration by Amy Bartlett Wright from THE DIVERSITY OF LIFE by Edward O. Wilson. Copyright ©1992 by Edward O. Wilson. Used by permission of Harvard University Press.

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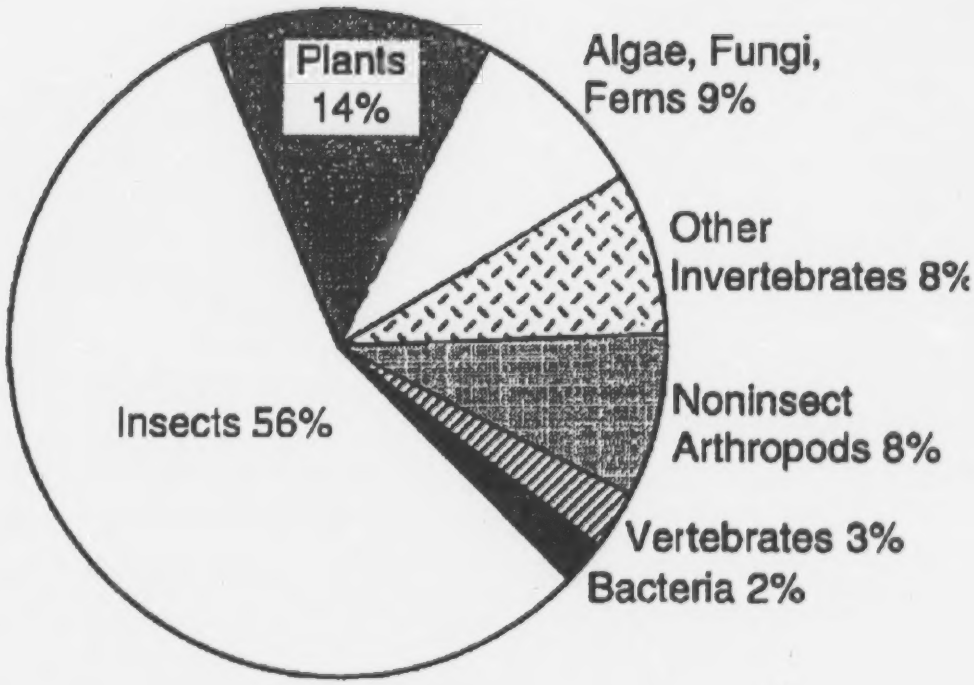
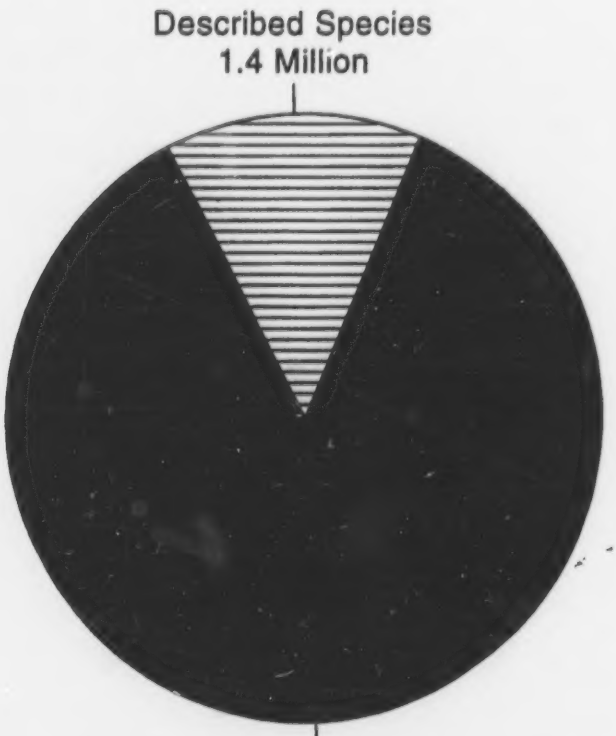
Categories of Species that are Classified and Included in Biodiversity



Reproduced by permission from *Saving Nature's Legacy*, 1994. Copyright ©1994 by Defenders of Wildlife.

Species Remaining to be Described



Estimated Total Species = 10 Million

Reprinted with permission from World Resources Institute. "Biodiversity," *Teacher's Guide to World Resources, 1992-1993*. New York: Oxford University Press, 1992.

LEVELS OF BIODIVERSITY

With your partner, give an example of each level of biodiversity drawing on examples from your own state, province, or region. For example, you might describe several of the ecosystems in your state, several species that might be found in one of those ecosystems, such as a lake, and the genetic diversity of a species, such as a trout.

Ecosystem Diversity

State, province, or region _____

Give several examples of ecosystems within the state, province, or region you selected.

Species Diversity

Select one ecosystem from those listed above: _____

Give several examples of species within the ecosystem you selected.

Genetic Diversity

Select one species from the list you created: _____

Give several examples of genetic variations within that species.

Adapted from the overhead "Examples of Levels of Biodiversity" from lesson: What is Biological Diversity? pp. 15-22 by Robert Blair and Heidi Ballard, *Conservation Biology*. Stanford, CA: Center for Conservation Biology, 1994.

KEY WORDS

Key Words	Definition
ecosystem	
ecosystem diversity	
environment	
extinction	
genetic diversity	
preservation	
species	
species diversity	
species introduction	
regenerative use	

KEY WORDS—ANSWER SHEET

Key Words	Definition
ecosystem	the organisms living in a particular environment, such as a lake or a forest (or, in increasing scale, an ocean or the whole planet), and the physical part of the environment that affects on them.
ecosystem diversity	classification of biodiversity at the ecosystem level, based on the group of organisms living in a particular environment and the physical part of the environment affecting them
environment	the surroundings of an organism of a species: the ecosystem in which it lives, including both the physical environment and the other organisms with which it comes in contact
extinction	the termination of any lineage of organisms, from subspecies to species
genetic diversity	classification of biodiversity at the level of the individual gene, based on the DNA code
preservation	to keep safe from injury, harm, or destruction
species	basic unit of classification, consisting of a population or series of populations of closely related and similar organisms
species diversity	classification of biodiversity at the species level, based on organisms that are similar or closely related
species introductions	when species are accidentally or intentionally brought to an area causing the extinction of the local plants and animals
regenerative use	a form of community-based land management strategy that both provides for community needs and maintains the area's biodiversity

Orientation Activity

WHY IS BIODIVERSITY IMPORTANT?

Overview

The purpose of this *Orientation Activity* is to acquaint students with the value of biodiversity and why there is concern over threats to plant and animal species throughout the world.

Objectives

- to discuss the importance of biological diversity to humans
- to identify how stresses on biological systems endanger both individual species and whole ecosystems with broad-reaching effects

Time

One class period

Materials

- Handout 4: *Valuing Biodiversity*
- Handout 5: *Plant and Other Natural Product Collection*
- Handout 6: *Threats to Biodiversity*

Suggested Procedure

1. Divide the class into groups of four or five. These groups will work together throughout the remainder of the unit.

2. Give each group Handouts 4-6. Ask each group to review the materials together and then to create a collage that demonstrates the importance of biodiversity and how it is being threatened. Encourage them to add ideas of their own to the collage. Allow about 30 minutes for each group to work together to review the materials and create the collage.

3. Ask the students some of the following questions:

   - How important is biodiversity to humankind's future?
   - What are its most important contributions?
   - What possible threats exist to the earth's biodiversity?
   - Should humans try to reduce the threats to the earth's biodiversity? If so, what are some of the ways they might do this?
   - What are some of the other goals that might compete with preserving biodiversity for attention and funding?

4. Tell the students that over the next several days they will be exploring some of the options for preserving biodiversity. Ask each student to develop a list of questions that they hope to answer during this unit. Allow about five minutes for this activity.

Reference Materials

World Resources Institute. *World Resources 1994-95: A Guide to the Environment*. New York: Oxford University Press, 1994.

VALUING BIODIVERSITY

Biodiversity is our most valuable but least appreciated resource. Its potential is brilliantly illustrated by the maize species Zea diploperennis, a wild relative of corn discovered in the 1970s by a Mexican college student in the west central state of Jalisco, south of Guadalajara. The new species is resistant to diseases and unique among living forms of maize in possessing perennial growth. Its genes, if transferred into domestic corn (Zea mays), could boost domestic production around the world by billions of dollars. The Jalisco maize was found just in time, however. Occupying no more than 10 hectares (25 acres) of mountain land, it was only a week away from extinction by machete and fire.

It can be safely assumed that a vast array of other beneficent but still unknown species exist. A rare beetle sitting on an orchid in a remote valley of the Andes might secrete a substance that cures pancreatic cancer. A grass down to twenty plants in Somalia could provide green cover and forage for the saline deserts of the world. No way exists to assess this treasure house of the wild except to grant that it is immense and that it faces an uncertain future.

E. O. Wilson. *The Diversity of Life.*
New York: W. W. Norton and Company, 1992, p 281.

***

What is life? It is the flash of a firefly in the night. It is the breath of a buffalo in the winter time. It is the little shadow which runs across the grass and loses itself in the sunset.

Crowfoot. The Earth Speaks.
Warrenville, IL: The Institute for Earth Education, 1983, p. 132.

***

Let a man once begin to think about the mystery of his life and the links which connect him with the life that fills the world, and he cannot but bring to bear upon his own life and all other life that comes within his reach the principle of reverence for life...

Albert Schweitzer. *The Earth Speaks.*
Warrenville, IL: The Institute for Earth Education, 1983, p. 133.

***

The frog does not drink up the pond in which he lives.

Indian proverb. *The Earth Speaks.*
Warrenville, IL: The Institute for Earth Education, 1983 p. 67.

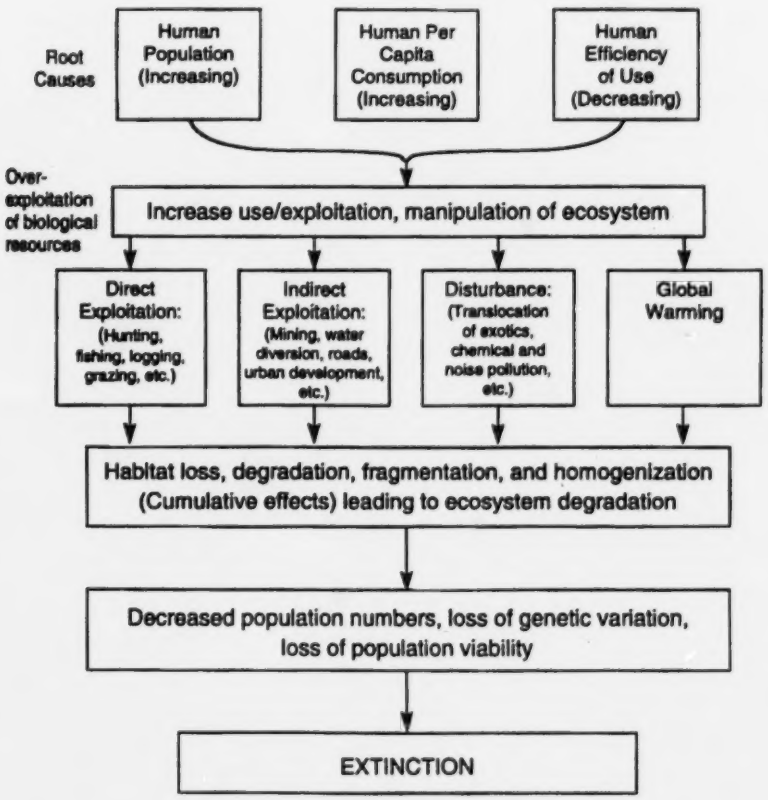
PLANT AND OTHER NATURAL PRODUCT COLLECTION

Select International Companies Active in Plant and Other Natural Product Collection and Screening, 1950 to the Present

		Treatment Sought for					
Company	Products Collected	Cancer	AIDS	Inflammation	Cardio-Vascular Problems	Gastro-Intestinal Problems	Other
Abbott Laboratories	Microbes, plants				•		•
Boehringer Ingelheim	Microbes, plants				•		•
Bristol-Myers Sqibb	Fungi, microbes, marine plants	•					•
CIBA-GEIGY	Microbes, marine plants	•		•	•		•
Eli Lilly	Plants, algae	•			•		•
Glaxo Group Research	Fungi, microbes, marine plants	•		•	•	•	•
Inverni della Beffa	Plants			•	•		•
Merck & Co.	Fungi, microbes, marine plants	•		•	•	•	•
Miles	Microbes, plants, marine fungi				•		•
Monsanto	Plants, microbes			•	•		•
National Cancer Institute	Plants, microbes, insects, marine fungi, algae, invertebrates	•				•	
Pfizer	Plants, spider venom	•		•	•	•	•
Pharmagenesis	Natural Products used in traditional Asian medicine			•			•
Phyto pharmaceuticals	Plants	•					
Rhone-Poulenc Rorer	Plants, marine microbes	•	•		•		•
Shaman Pharmaceuticals	Plants						•
SmithKline Beecham	Microbes, marine plants			•		•	•
Sphinx Pharmaceuticals	Plants, marine fungi, algae	•				•	
Sterling Winthrop	Microbes, marine plants	•		•			
Syntex Laboratories	Plants, microbes	•		•	•		•
Upjohn	Plants, microbes		•		•		•

World Resources Institute. *World Resources 1994-95: A Guide to the Environment*. New York: Oxford University Press, 1994, p. 159.

THREATS TO BIODVERSITY


Root Causes
Human Population (Increasing)
Human Per Capita Consumption (Increasing)
Human Efficiency of Use (Decreasing)
Over-exploitation of biological resources
Increase use/exploitation, manipulation of ecosystem
Direct Exploitation: (Hunting, fishing, logging, grazing, etc.)
Indirect Exploitation: (Mining, water diversion, roads, urban development, etc.)
Disturbance: (Translocation of exotics, chemical and noise pollution, etc.)
Global Warming
Habitat loss, degradation, fragmentation, and homogenization (Cumulative effects) leading to ecosystem degradation
Decreased population numbers, loss of genetic variation, loss of population viability
EXTINCTION

Relationship between root causes, overexploitation of resources, and loss of biodiversity. The final result is extinction.

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Activity One

SPECIES PRESERVATION

- Activity One explores one strategy of species preservation: treaties and agreements that ban certain activities and provide incentives to communities in order to protect a single species.

Species loss is a major problem on every continent, and it involves both plants and animals. The growth and spread of the human impact on the environment has been one of the primary factors in the disappearance of species in the past two hundred years. Although extinctions have occurred throughout time, scientists have indicated that species on earth are becoming extinct at a very high rate during the current time period.

Often the loss of individual species is little noticed, especially when it involves plants or small animals that are barely known outside of a small ecosystem. There is concern among scientists that invaluable resources are being lost before they can even be identified or their value understood.

One of the strategies to prevent the loss of individual species is to establish policies that ban certain activities in order to protect a particular species. Much public attention has been given to bans of logging activities in the forests of the northwestern United States to protect the spotted owl and on whaling activities throughout the world to protect endangered species of whales. Debate continues on the long-term effectiveness of these strategies.

The decline in the population of African elephants has attracted attention that is unusual. The loss of elephants is due not only to the spread of agriculture and other human activity in Africa, but also to the trade in ivory. Although many African countries banned elephant hunting in order to protect a valuable tourist attraction, poachers had a serious impact on elephant herds in the past twenty years. In order to provide more incentive for local farmers and herders to assist government wildlife rangers, a number of countries have developed programs to assist local communities that help protect elephants. In some cases, farmers are paid compensation if elephants damage their crops. In other cases, local villages are paid a percentage of tourist revenues, so that they will benefit from the protection of elephants.

Outline of Activity

Students read through an article describing the debate over the culling of elephants and the establishment of a legal ivory trade and review several graphs and charts that provide information about the topic. The resource cards provides information on the debate between different African countries on how best to preserve their elephant populations, reduce poaching and also protect limited land resources. Students then simulate a meeting of representatives of African countries who have come together to discuss the preservation of the elephant.

Extension Questions

- What did your group learn about the difficulties in protecting just one species?
- What did you already know about elephants and the protection of species?
- How is the protection of elephants different from the protection of species such as individual butterflies or plants such as a particular type of tropical tree? How is it similar?
- What are the strengths and weaknesses of the strategy of protecting individual species?

Related Issues

- international trade in restricted goods
- relationship between human populations and other species

Reference Materials

World Resources Institute. *World Resources 1992-93: A Guide to the Environment*. New York: Oxford University Press, 1992.

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SPECIES PRESERVATION ACTIVITY CARD

There have been many debates about what strategies are best to preserve species of plants and animals. One strategy used by some countries has been to ban certain activities such as ivory trade or logging operations.

As a group, read the *Resource Cards* and discuss the questions below:

1. What did the countries hope to accomplish by banning ivory trade?
2. What were some of the unexpected effects of the ban on ivory trade?
3. How effective was the strategy of banning ivory trade in preserving elephants in Africa?
4. Should the ban on ivory trade ever be discontinued?
5. What other agreements could the countries have made to help preserve the elephant species?

GROUP TASK

Countries often work together cooperatively to develop policies that help preserve plant and animals species. Assume that members of your group are representatives of several countries who are meeting to discuss the preservation of the African elephant. Develop a skit that demonstrates the questions and issues your committee must consider before deciding on a plan for preserving the elephants.

SPECIES PRESERVATION RESOURCE CARD (1 OF 3)

ELEPHANT IVORY BAN

After eight years during which poaching reduced African elephant populations by roughly 50 percent, most countries participating in the Convention on International Trade in Endangered Species (CITES) agreed to a ban on ivory trade in 1989. The ban, along with other conservation efforts, seems to have been effective. Poaching has decline drastically in some (though not all) areas, and the price of ivory has dropped to a few dollars per kilogram (in 1989 the price was as high as $100 per kilogram). Elephant populations are stabilizing or increasing, and elephants are beginning to return to areas such as northern Kenya, where they had been eradicated.

All countries have officially stopped exporting ivory, including the southern African countries that were opposed to the ban. The lower market price has made ivory more affordable for many Africans, and domestic consumption appears to have increased since the ban.

These countries have carried out few elephant herd culls since the ban because they are no longer economically feasible. But pressure to thin herds is increasing, as elephant populations grow. In Botswana, for example, the elephant population has reached about 67,000, but government officials say the nation's preserves can sustain only 55,000 animals. Botswana officials say the herd is damaging water and plant resources; they want to cull 3-5 percent of the herd annually. Other southern African nations are expected to join in the effort to permit sustainable culling of herds. Five states (Botswana, Namibia, Zimbabwe, Malawi and Zambia) want to establish a Southern African Ivory Marketing Center that will auction and be exempted from the CITES ban. A new scientific technique has been developed that can be used to identify legal ivory as opposed to ivory from poached elephants. Proponents say such a market could put revenue back into the hands of African governments, which could use the money for elephant conservation.

World Resources Institute. *World Resources 1992-93: A Guide to the Environment*. New York: Oxford University Press, 1992, p. 133.

SPECIES PRESERVATION RESOURCE CARD (2 OF 3)

Estimated Elephant Numbers: Regions and Selected Countries

	1981	1989
Zaire	376,000	112,000
Central African Republic	31,000	23,000
Congo	10,800	42,000
Gabon	13,400	74,000
Central Africa Total	**436,500**	**277,000**
Kenya	65,000	16,000
Tanzania	203,900	61,000
Sudan	133,700	22,000
East Africa Total	**429,500**	**110,000**
Botswana	20,000	88,000
South Africa	8,000	7,800
Zambia	160,000	32,000
Zimbabwe	47,000	52,000
Southern Africa Total	**309,000**	**204,000**
West Africa Total	**17,600**	**19,000**
Africa Total	**1,192,300**	**609,000**

Economic Benefits of Different Elephant Management Options, Botswana ($1 = 1.8 pula)

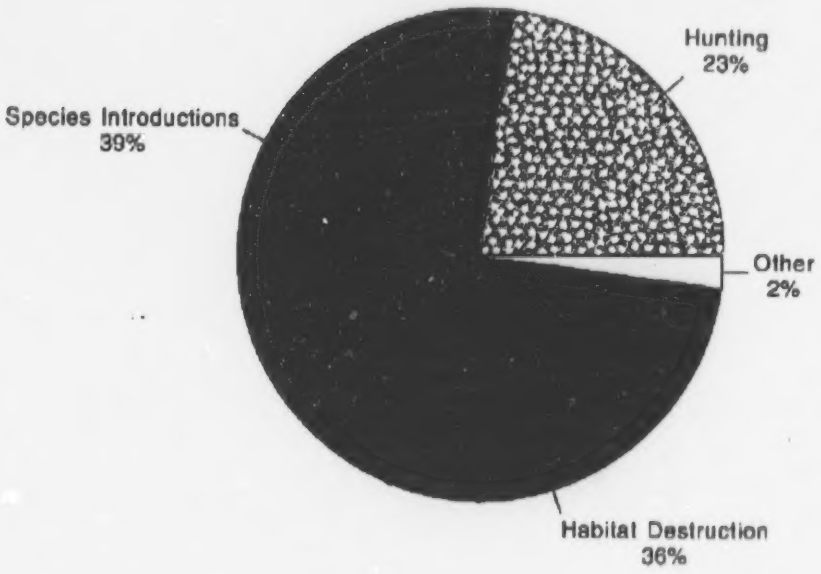
	Net present value @ 6% (m pula, 1989)		
Option	after 5 years	after 10 years	after 15 years
1. Game viewing with no consumptive uses	34.7	98.1	160.6
2. Game viewing with elephant cropping	91.2	198.4	288.9
Difference (2-1)	56.5	100.3	128.3
Net Benefits from consumptive uses°	60.0	110.1	144.4

°The difference between options 1 and 2 is only an approximate indicator of the net benefits from consumptive uses, as the introduction of elephant cropping reduces the benefits from game-viewing tourism by 10%. By allowing for this reduction, the net benefits from consumptive uses can be calculated.

Reprinted with permission from Cairncross, Frances. *Costing the Earth.* Boston, MA: Harvard Business School Press, 1991. p. 137, 139.

Species Preservation Resource Card (3 of 3)

Known Causes of Animal Extinctions since 1600



Reprinted from World Resources Institute. *World Resources 1994-1995: A Guide to the Environment*. New York: Oxford University Press, 1994.

SPECIES PRESERVATION
INDIVIDUAL REPORT

Name:_____

How effective is the strategy of creating laws that protect only one species?

Activity Two

REGENERATIVE USE

- Activity Two explores ways to preserve biological species through regenerative use. Regenerative use is a form of community-based land management strategy that both provides for community needs and maintains the area's biodiversity.

The idea of regenerative use is rooted in concerns for protecting and preserving biodiversity, while also meeting the needs of local communities. It is based on the belief that current economic, and particularly, agricultural practices, cannot sustain or regenerate the earth's resources for future generations. The reference to regeneration, rather than just to sustainability or preservation, is an acknowledgment that sometimes communities have to increase their resources, because so much has been lost in the past.

Until recently, our understanding of economic growth was based upon increased use and consumption of the earth's resources. The emphasis on satisfying economic and social needs through growth is no longer acceptable, especially when many communities lack even the basics for adequate welfare. More growth and consumption will not meet their future needs if it results in the destruction in their natural resources.

One of the greatest obstacles to encouraging regenerative use has been the lack of understanding of local environments and what local communities know about their resources. Regenerative use will only succeed when it involves the people of the communities where the need for preservation is the greatest. These communities cannot afford programs that undermine their own survival.

One way of thinking about regenerative use is to consider that people everywhere need to have a livelihood, ways of providing for themselves and their families. Regenerative use is based on the ability of protecting or enhancing the resources available to communities. This helps people have access to food or cash, as well as some reserves (such as animals, trees, marketable products) that can help them meet their basic needs. This kind of security can come from different sources, such as farming, raising livestock, gathering forest products, employment opportunities, or a combination. The key is to secure a livelihood that is consistent with regenerating the resource base of the community.

Outline of Activity

Students read an article describing a project in Peru designed to both restore and preserve biodiversity, while drawing on local knowledge and resources. They then work together to develop a similar project for their own local community.

Extension Questions

- What is the relationship between agricultural practice and regenerative use?
- How are the needs of a farming community related to the protection of biodiversity?
- What role does agricultural science play in helping determine effective land management strategies?
- What role does local, culturally-based knowledge play in helping determine effective land management strategies?

Related Issues

- agricultural research/agricultural science
- sustainable development
- Green Revolution
- organic agriculture

Reference Materials

Smith, Kate. *Growing Our Future.* West Hartford, CT: Kumanrian Press, 1993.

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Regenerative Use Activity Card

People everywhere need to have a livelihood, ways of providing for themselves and their families. Regenerative use is based on the ability of protecting or enhancing the resources available to communities.

As a group, read the *Resource Card* and discuss the questions below:

1. What needs was the HIFCO project trying to address?
2. How did the community change after the HIFCO project began?
3. How do you think local community members felt about the project?
4. How can a project like HIFCO contribute to maintaining a culture over time?
5. What kinds of knowledge are required to develop a plan for regenerative land use?

Group Task

As a group, plan a project for your local community that will help restore and increase some of its natural resources while meeting other community needs. Create a three-dimensional model of the project that shows its different parts and how they will work together.

Regenerative Use Resource Card

Peru's HIFCO Project: Sustainable Agroforestry for Cultural Survival

Located amidst abandoned farms and degraded pastures, the HIFCO project near Pucallpa in Peru's Amazon is a significant example of how sustainable forest practices can contribute to both ecological restoration and cultural preservation. When a road was opened from Lima to Pucallpa in the mid-1960s, Pucallpa area forests were rapidly and extensively depleted through colonization and conversion to crop and pasture land. In the process, the indigenous people lost access to their traditional lands. By 1985, when HIFCO began, the area was dominated by low-productivity pastures and degraded farmlands heavily laced with pesticide residues.

The HIFCO experiment arose in response to the need for dependable food production on the degraded sites and the desire of the local Shipibo Indians to restore their homeland. An 11-hectare abandoned cattle pasture was leased, and a sustainable farming system using intercropping and infiltration ditches was introduced. HIFCO farmers use a novel combination of traditional and modern agricultural practices to work their land. Learning from natural forest species diversity, they planted more than 40 species of annuals and perennials, which are surrounded by a variety of tree species. Leguminous plants and green mulches are used extensively throughout the garden as a source of nitrogen, and the trees not only produce fruits and timber but support vine crops, allowing more efficient use of garden space. The area around the garden is being replanted with some 60 species of trees.

HIFCO's production is not limited to plants. Fish ponds and guinea pigs, geese, ducks, guinea hens, and other small farm animals provide protein and are an incidental source of fertilizer. HIFCO's holistic approach extends to pest control through interplanting insect-repellent plan varieties, such as marigolds and sesame, and using a home-brewed organic pesticide. The HIFCO project also includes a crop improvement program, complete with a seed bank and a program of field trials.

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REGENERATIVE USE
INDIVIDUAL REPORT

Name:_____

How can local communities meet their basic needs for survival and also help preserve biological diversity?

Activity Three

BIOSPHERE RESERVES

- Activity Three explores the concept of biosphere reserves. This relatively new idea treats regions as a whole in considering strategies for preserving and enhancing biodiversity.

In thinking about the protection of species, it is important to understand that in many cases species will only be preserved when there is a program for protecting an entire biosphere region. The protection of bioregions involves more than the protection of individual species. It is focused on the protection of whole biological regions, which includes species, the interaction between elements of an ecosystem, and a certain level of unknown qualities that are deemed desirable. The recognition of the need to protect bioregions or biospheres is influencing policies throughout the world, both in industrialized and developing countries.

In the United States, there has been a long tradition of protecting environmental space, though it did not begin with the same level of knowledge and understanding that exists today. The conservation movement that emerged in the late nineteenth century, which was connected to the closing of the frontier and the work of early conservationists led to the first national parks and the idea of protected wilderness areas. The parks and wilderness areas were large enough to allow for wildlife to have protected habitats, to establish priorities for protection and to provide for possible rebuilding of the stock of animals in danger of extinction. Similar conservation traditions have existed elsewhere in other countries such as New Zealand and many European countries.

In developing countries, there has been a different history of attention to biosphere reserves, in part because the focus on reducing poverty overshadowed conservation goals. Also those countries with areas that have predominantly agricultural or livestock raising populations needed new land to accommodate growth and replace depleted land. However, over the last two decades the concept of biosphere reserves has moved from one imposed from the outside to one that is often connected with local traditions and values in these countries. Developing countries have become more aware that they are losing valuable resources through biosphere depletion. They recognize that they cannot alleviate poverty without protecting their natural resources.

The establishment of biosphere preserves is a difficult challenge, and requires an approach that looks at the management of an ecosystem, rather than protecting a particular species. In many cases, the scientific data needed to inform decisions about creating such large systems of protection is limited.

activity three

Outline of Activity

Students examine several schematic drawings of biosphere reserves and then apply the principles of biosphere reserve management to creating a design for their own region.

Extension Questions

- What are some of the differences between national parks and biosphere reserves?
- What would be required for a national park to become a biosphere reserve?
- How do biosphere reserves relate to the protection of individual species?

Related Issues

- UNESCO-Man and the Biosphere Programme
- Community empowerment
- ecosystems management
- genetic resource preservation banks

Reference Materials

DiSilverstro, Roger. *Reclaiming the Last Wild Places*. New York: John Wiley, 1993.

Noss, Reed F. and Allen Y. Cooperrider. *Saving Nature's Legacy*. Washington, D.C.: Island Press, 1994.

UNESCO Sources. Paris: UNESCO, November 1991 and November 1992.

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BIOSPHERE RESERVES ACTIVITY CARD

International interest in the establishment of biosphere preserves grew in the 1970s with a strong impetus from UNESCOs "Man and Biosphere Program." Within a ten-year period between the mid-1970s and the mid 1980s, over 250 preserves had been established in about 70 countries.

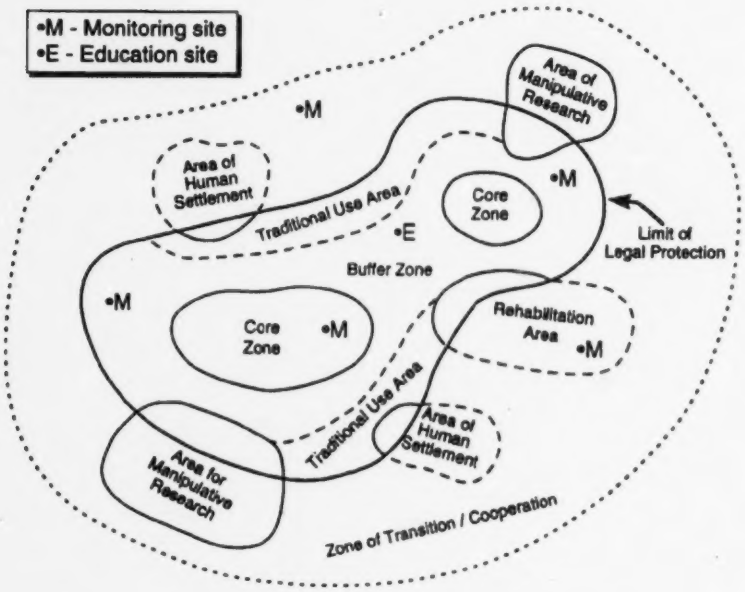
As a group, examine the *Resource Card* and discuss the questions below:

1. Why would countries establish biosphere reserves?
2. What does the design of these reserves tell you about how they protect the environment?
3. What are some of the ways that biosphere reserves accommodate the needs of both humans and the environment?
4. How is a biosphere reserve different from a national park?

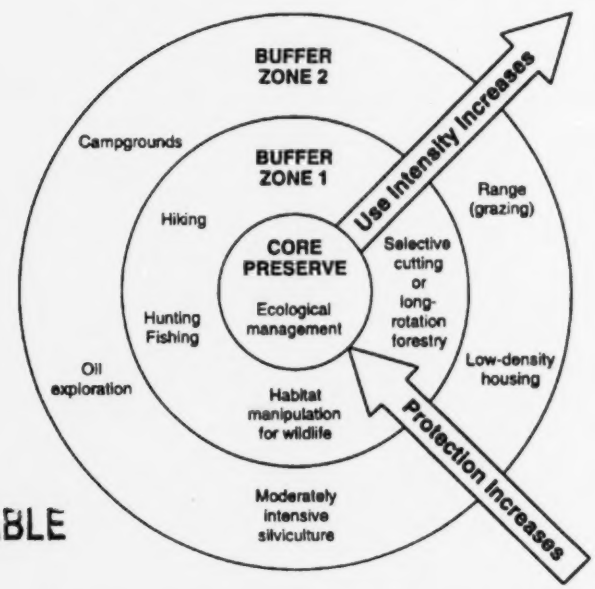
GROUP TASK

Design a biosphere reserve for your region. Present your design to the class.

BIOSPHERE RESERVES RESOURCE CARD (1 OF 2)



Conceptual layout of an ideal biosphere reserve



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A multiple-use module (MUM). An inviolate core reserve is surrounded by a gradation of buffer zones, with intensity of human use increasing outward and intensity of protection increasing inward.

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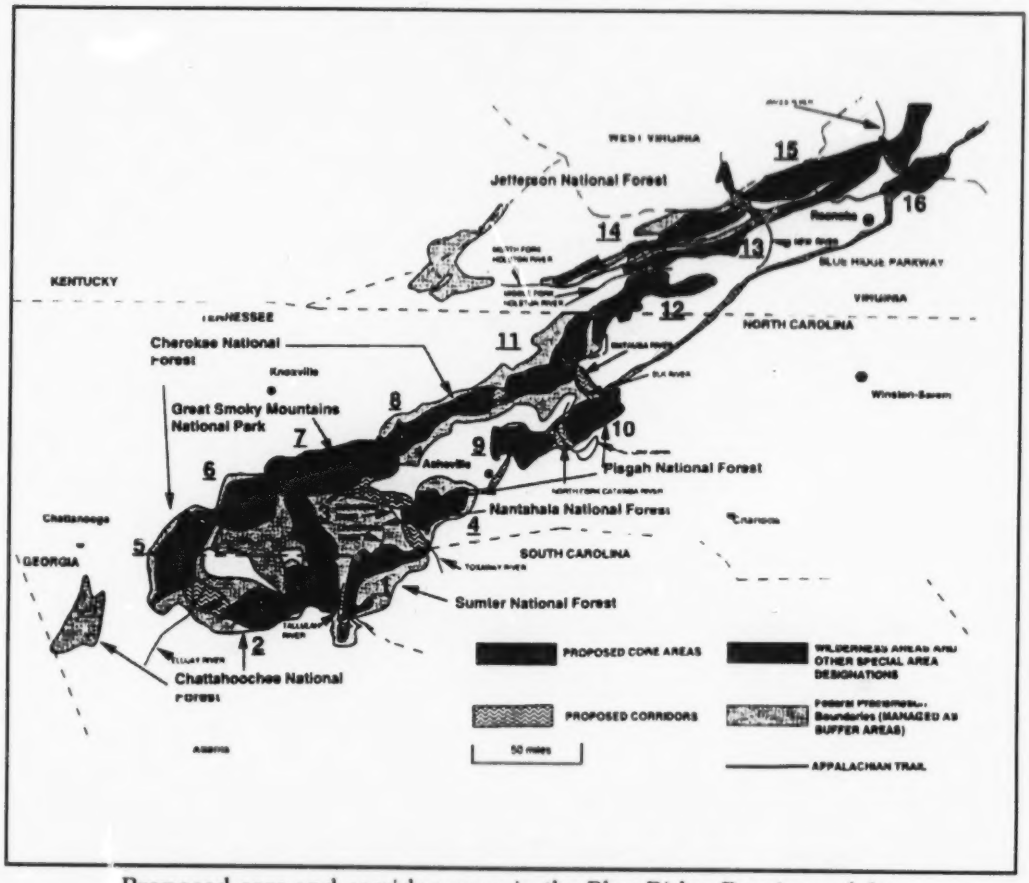
BIOSPHERE RESERVES
RESOURCE CARD (2 OF 2)



Proposed core and corridor areas in the Blue Ridge Province of the Southern Appalachian Bioregion.

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BIOSPHERE RESERVES
INDIVIDUAL REPORT

Name:_____

Why would a region interested in preserving biodiversity establish a biosphere reserve?

Activity Four

ECOTOURISM

- Activity Four shows how the promotion of ecotourism, a form of travel that reflects both environmental and economic goals of local communities, has been used as a preservation strategy.

A number of approaches have been attempted in recent years in order to preserve biodiversity while maintaining a long term view for meeting local human needs. One of the recently popular approaches is termed "ecotourism." This strategy links together the need to generate both funds and local incentives for protecting natural resources with the interest in developed countries of using biologically rich settings as vacation destinations. Some of the potential values of ecotourism include the provision of funds to protect rare species and ecosystems, the education of visitors about the value and importance of biodiversity, and the opportunity for local people to benefit from the protection of habitats.

A good example of both the promise and the difficulty in promoting ecotourism is found in the efforts of small islands to generate income and protect their fragile resources through ecotourism programs. Islands are favored as vacation destinations by people throughout the world. Among environmental biologists, they are renowned for the diversity of their species. Even more important, islands have a large number of endemic species—plants and animals that occur there, and nowhere else. Because islands are separated from other land masses, often by large expanses of ocean, their life has evolved distinctively. They thus make an important contribution to the biological wealth of the entire planet.

These biological resources are also of great aesthetic, economic, cultural and spiritual value to islands and their peoples. They are used for food, to provide shelter, as the basis of economic activity, and for trade with the rest of the world. Often, fewer economic options are available to these small island states than to larger countries, and so their biological resources are extraordinarily important. Their modern tourist industries, the new basis of many of island economies, are founded on their natural beauty, variety and uniqueness, as well as on the reputation of the graciousness of the island peoples to visitors.

But small is also vulnerable. The very size and virtual isolation of these islands make their ecosystems, both on land and in the sea, particularly fragile. And smallness exacerbates this further by creating small feedback loops in ecological processes, accelerating them and magnifying their impact beyond what would be expected in a larger system. External or internal threats—whether from agricultural practices, mining, oil spills, the pattern of coastal settlements or the modification of the climate—cannot be readily contained. Little errors can therefore lead to big consequences both for the environment and for natural wealth. In small islands, with limited land space and few options, this can be devastating.

activity four

The long term outlook for ecotourism is uncertain because it is still a very recent phenomenon. Small island states have a particular investment in this concept because the options for the people in terms of earning a living are limited.

Outline of Activity

Students examine an advertisement promoting ecotourism and read an article exploring the issue of whether tourism can be ecologically sound. They then create a travel brochure promoting their own community as a destination for ecotourists.

Extension Questions

- What type of tensions exist between ecotourism and protecting biodiversity on small islands?
- What messages about biodiversity is a traveler to ecotourist destinations likely to receive?
- What is the potential impact of ecotourism on other non-island vacation destinations?

Related Issues

- "Wise Use" Movement
- Scientific research on impact of tourism on the environment
- Economic success vs. quality of life indicators
- respect for local cultures
- global impact of media and consumer culture

Reference Materials

Healy, Kevin and Elayne Zorn, "Taquile's Homespun Tourism," in Charles David Kleymeyr, ed., *Cultural Expression and Grassroots Development*. Boulder: Lynne Rienner, 1994.

Our Planet, United Nations Environment Programme, Nairobi, Kenya, 1994.

Wood, Megan Epler, "Global Solutions: An Ecotourism Society," in Tensie Whelan, Ed., *Nature Tourism: Managing for the Environment*. Washington, D.C.: Island Press, 1991.

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ECOTOURISM ACTIVITY CARD

In recent years, a new idea called "ecotourism" has become popular. It is a form of tourism that many people believe is more beneficial to communities that are tourist destinations. It supports the idea that it is important to preserve the cultural and natural resources of a region in addition to benefiting economically from tourism.

As a group, examine the *Resource Cards* and then answer the following questions.

1. What are some of the effects of tourism on a community? Who benefits from tourism? Who or what is most harmed?

2. Why would an idea like ecotourism develop? How is it different from conventional tourism?

3. Why is the idea of ecotourism particularly important to people living on small islands?

4. As a tourist, how would the idea of ecotourism affect your vacation to a place like Hawaii? What would be your reactions to that kind of a vacation?

5. What are some other ways that communities could protect their resources and maintain a solid economic base for their people?

GROUP TASK

As a group, design a travel brochure that uses ideas of ecotourism to describe the benefits of a vacation to your community.

ECOTOURISM RESOURCE CARD (1 OF 2)

Pearl's Borneo & the Ring of Fire

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Escape (e-skap, e-), 1. to flee from, 2. to avoid, 3. to be forgotten by, 4. a temporary mental evasion of reality

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AUSTRALIA'S NORTHERN TERRITORY

ECOTOURISM RESOURCE CARD (2 OF 2)

SAFE TOURISM—IT IS POSSIBLE

by Lelei Lelaulu

In the late 1960s I helped out with a study which canvassed Samoan comunity leaders' views of tourism. All the answers were uniformly positive. Yes, they were in favour of tourism. But I had a nagging doubt about their responses, which despite their positive nature, seemed somewhat tentative. So I pressed one of the elders a little more; a delicate move in the Samoan culture which treats direct questions as ill-mannered at best, and at worst, a provocation.

Eventually, he admitted it was indeed a joy to speak with people from faraway lands and to hear how they lived—but he said he did not think they could afford more visitors. A completely unexpected reaction as, like most young islanders at the time, I could see only benefits accruing from strangers with bulging wallets from faraway lands. I had overlooked the fact that Samoan, and indeed Polynesian, culture demands that visitors be offered the best of their food and a great deal of their time. So, the village elder was saying, that while the odd visitor was always welcome, a constant flow of outsiders threatened to bankrupt villagers balancing within a subsistence economy.

The end result of such findings led the Western Samoan government to mandate that all tourists had confirmed hotel reservations and onward tickets—before they were issued visas. It was a simple way of controlling the number of visitors and ensuring they were safely bedded down every night at a hotel and not on a beach or in someone's home. And to control the flow of visitors all the government needed to do was to limit the number of hotel beds available. An easy option for then Prime Minister Tupua Efi Tamasese, who was reluctant to develop tourism as a major earner because in his words, "I don't want this proud country to become a nation of wine-waiters."

MODEL NEEDED

In Barbados, Dr. Colin Hudson—who is putting together the imaginative "Village of Hope" as part of the non-governmental activities for the Global Conference on the Sustainable Development of Small Island Developing States, which, among other things, offers models of sustainability in different areas—said there was only one model for emulation they could not find: one for sustainable tourism.

Most resource-poor island states trying to eke out a living in the global economy cannot afford to pass up

the economic opportunities tourism offers. As they reel from the continuing slide of international commodity prices, many have no alternative but to offer their natural beauty—and cheap labour costs—to attract the tourist industry. Following the rules for sustainable tourism—while tough—could reduce the risks to the environment.

WHAT ARE THE RULES?

So, what rules keep you profitably safe and sustainably beautiful?

The first rule is: keep tourists all in one place for as long as you can during their visit to your island. Leaving aside the pesky issues of foreign ownership and oversaturation, Hawaii can teach us a few things about safe tourism. The world's most recognized tourist destination is Waikiki. Now Waikiki was not always a beach—it was a swamp before developers trucked in white sand to create the fabled strand. The hotels on Waikiki all rose out of the same swamp and reclaimed lands. Which neatly encapsulates your second rule of safe tourism: do not displace any existing destinations.

Waikiki itself, with some 30,000 hotel rooms, covers little more than 17 city blocks. Despite its small area, the great majority of the 5 million tourists who visit Hawaii every year do not venture beyond this luxurious ghetto, much to the delight of indigenous communities. Have you ever tried to get an hotel room outside of Waikiki on the island of Oahu? It is tough to find a hotel. And there are no plans to approve any more, say aides to Governor John Waihe'e, Hawaii's first Polynesian governor. Governor Waihe'e seems proud of the fact that he has not approved a major tourist development since he took office.

Another rule: take fewer toursts who will stay longer and spend more. A report commissioned by the (former) Hawaii governor's office found that the 4 million people who visited the islands in 1984 spent an average of 10 days and unloaded $1,000 per head. Not a good sign, because infrastructural constuction and maintenance costs, already hovering around $1 billion a year, rise to keep up with such huge numbers of visitors to an island state with a total population of about a million. And do not forget that close to 60% of the tourist receipts are immediately repatriated off-island.

With the concentration on volume, massive hotels had to be built to cope with the millions of bodies that the airlines were dumping on the island—with discount fares designed to put bottoms on the much larger number of seats in the huge 747s. In many cases the bigger hotels were relying on package tours for half their occupancy rates.

And what is wrong with big hotels? You can imagine the amount of water, energy, personnel, roads and the like which have to be diverted to such large constructions—paid for by local tax-payers. Building huge hotels requires enormous amounts of money which are available only in the metropolitan countries—which in turn means handing ownership over to off-island corporations. Owners from distant places have a history of tying their continued presence abroad to the amount of incentives offered by the authorities, which are already saddled with infrastructural costs—while the vast majority of revenues from tourism are repatriated off-island.

HIGHER CALIBRE VISITORS

Hawaii has redirected its efforts to attract fewer visitors of a higher calibre. By so doing, the resorts are smaller, less costly, and much more pleasant places to visit. It was ironic that the most successful, and expensive resorts in Hawaii were the smaller ones like Hana Maui Ranch, which had neither television nor air-conditioning. Hana Maui Ranch did have a cultural show—but it did not feature professional entertainers—those dancing for the guests were the maids, gardeners, accountants and managers of the hotel—all of whom were local Polynesians. Yet it continues to enjoy some of the highest return rates anywhere.

That leads me to another rule: involve the local community. Ensure your success is shared by them. Offer local farmers and business folk the first opportunity to provide your resort with food. A letter from your resort to a grower guaranteeing to buy all they can grow of certain vegetables can be used by the farmer to get a favourable loan from the local bank. Instead of importing, for example, an artist-in-residence, which is fashionable in the top resorts, appoint local artists and import a coastal-botanist-in-residence, and give the findings to the local authorities—thereby increasing the knowledge the community has of its own natural resources. Also consider marine biologists, musicologists, agronomists, and for the really confident and savvy, mythologists. In other words try to improve the lot of the locals. If you do not, then you are sentencing yourself to eventual failure which will first manifest itself in surly workers and expletives hurled at your hotel guests. When you first notice these signs—find a buyer quick.

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ECOTOURISM
INDIVIDUAL REPORT

Name:_____

What are some of the ways that an idea like ecotourism can help preserve the world's biodiversity?

Activity Five

PUBLIC/PRIVATE PARTNERSHIPS

- Activity Five explores the ways that public agencies and private business may work together to both preserve biological diversity and meet other important goals such as identifying and using resources to combat disease and feed a growing population.

More than half the world's plant and animal species live in one tropical forest or another, and nowhere else on Earth. Coral reefs and other coastal ecosystems add hundreds of thousands, if not millions, more species to the thin and variegated film of life that covers the globe. As the search for wild species whose genes can yield new medicines and better crops gathers speed, these rich habitats also sport more and more specimens of a relatively new breed, the biodiversity prospector. Like the nineteenth century California gold rush, or its present day counterpart in Brazil, this "gene rush" could wreak havoc on ecosystems and the people living in or near them. Done right, though, bioprospecting can bolster both economic and conservation goals while underpinning the medical and agricultural advances needed to combat disease and sustain growing human numbers.

Although many institutions around the world are pioneering a new field, one involving creative partnerships between public and private institutions is occurring in Costa Rica. The Instituto Nacional de Biodiversidad (INBIO) was founded in 1989 to help the national government. It serves as a clearinghouse for information on and monitoring of Costa Rica's flora and fauna, between 500,000 and 1,000,000 species. The name, location, conservation status and potential commercial uses of each species are catalogued on computer. Using the catalogue, researchers can look for possible chemical uses among newly described wild plant species.

For a fee, INBIO helps commercial uses "prospect" in the catalogue. INBIO's first major customer was Merck & Co., Inc., the world's largest pharmaceutical company, which has a successful history of developing pharmaceuticals from natural sources. In exchange for plant, insect and microbe samples from INBIO, Merck agreed to pay INBIO $1 million as well as royalties on the sale of any products that Merck ultimately develops. Both Merck and INBIO hope that useful chemicals found in samples can then be synthesized in the laboratory rather than harvested from the forest. Part of the research funding will go to the Costa Rican National System of Conservation Areas to conserve biological diversity in the field.

Outline of Activity

Students read two brief articles outlining some of the arguments about the effectiveness of public/private partnerships in protecting global biodiversity. They then work as a group to design a product that they believe is both environmentally and economically sound.

Extension Questions

- How can public/private partnerships be balanced between unequal partners?
- What should the highest priorities be for effective public/private partnerships?
- When is it appropriate for public funds to be invested in these ventures?
- Are public/private partnerships more likely to create short or long term benefits? For whom?

Related Issues

- Relationship between local people and "outside" partners
- Global impact of transnational corporations
- Biotechnology and medicine
- Economic incentives for environmental preservation
- Intellectual property rights

Reference Materials

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PUBLIC/PRIVATE PARTNERSHIPS ACTIVITY CARD

In some countries, such as Costa Rica, partnerships between government agencies and private businesses have created research institutions and other mechanisms to help promote and develop the responsible use of the region's biodiversity.

As a group, read the *Resource Card* and discuss the questions below:

1. What are some of the ways that public and private agencies can work together to preserve biodiversity? What are some of the advantages and disadvantages of working together?

2. What role does scientific research and collection of information play in making decisions about the use of biodiverse resources?

3. What things are important to consider in deciding how a country or a community can protect both its economic, cultural, and natural resources?

4. Under what circumstances, if any, would you want your government to provide funding and support to encourage the development of products and services that responsibly utilize your country's resources?

5. Who should make decisions that affect the biodiversity of each local region?

GROUP TASK

As a group, design a product that you believe is both environmentally and economically sound. Develop a presentation to your local congressman that asks him to develop legislation that will provide funding to help you produce and sell your product.

PUBLIC /PRIVATE PARTNERSHIP RESOURCE CARD (1 OF 2)

PUBLIC-PRIVATE PARTNERSHIPS IN PROTECTING GLOBAL BIODIVERSITY

As international commitment to biodiversity protection grows, it is creating economic incentives to use biological resources efficiently, to preserve biologically diverse areas, and to answer demands for products derived from sustainable development practices. In light of this development, the investment of private capital in the biodiversity protection movement represents a potentially large and sustainable source of funding for conservation which can work hand in hand with public funds.

The venture capital fund concept is one application of public-private partnership. In biodiversity conservation, such a fund would serve as a bridge between government donor-funded activities and the private sector. Biodiversity investment areas could include:

- non-timber products from forests and wild lands (drugs, cosmetics and industrial products from plants/animals; food products; ethnobotanical products);
- timber from low impact sustainable harvest from primary forests;
- ecotourism;
- preservation of crop varieties and development of under-used species in agriculture, and
- aquaculture and game ranching of species threatened in the wild.

One advantage to converging public and private interests through initiatives like these is that, where as one-time public funding cannot necessarily ensure financial sustainability, these initiatives are more likely to become financially sustainable because they create private profit, while honoring and protecting national biodiversity objectives.

Newcombe, Kenneth. "Public-Private Partnerships in Protecting Biodiversity," *The Network*, Geneva: Center for Our Common Future, February/March 1994.

PUBLIC PRIVATE PARTNERSHIPS RESOURCE CARD (2 OF 2)

A FLAWED PROPOSAL: BIODIVERSITY CONSERVATION NEEDS ETHICS NOT MONEY

There are three fundamental conceptual flaws in the proposal put forward by Ken Newcombe. The first flaw is that assumption that scarcity of financial resources is the limiting factor in biodiversity conservation. The real limiting factor that threatens biodiversity is the absence of an ethic of compassion which makes protection of other species a moral imperative. No amount of finances can make up for the moral poverty of totally market-oriented cultures. In fact, biodiversity erosion is highest where financial investment is high and respect for life's diversity is low

The second flaw is the assumption that only the developing countries need biodiversity conservation. The impoverishment of monocultures is in fact higher in the industrialized countries and it is there that private investment should begin by regenerating biodiversity.

Finally, the definition of public-private used in describing a relationship between the World Bank and private corporations, it hides the fact that a significant part of the public domain, the communities themselves, who have conserved biodiversity and are its original custodians, have been totally excluded in defining what they need for biodiversity conservation. It is the erosion of community rights rather than scarcity of finances that are the reason for local communities losing the capacity to conserve the biodiversity they have protected for centuries.

My suggestions are as follows:

1. give up the assumption that money can compensate for a lack of compassion and care for other species and cultures;
2. begin with a reversal of the erosion of biodiversity in the industrialized world where the crisis of monocultures is more severe; and
3. respect the rights and values of other cultures and let them determine how they will relate to their local biodiversity and to non-local cultures which have values that conflict with their own.

Shiva, Vandana. "A Flawed Proposal: Biodiversity Conservation Needs Ethics Not Money," *The Network*, Geneva: Center for Our Common Future, February/March 1994.

PUBLIC/PRIVATE PARTNERSHIPS
INDIVIDUAL REPORT

Name:_____

What is your position on the importance and necessity of building public/private partnerships to preserve biodiversity?

Activity Six

PUBLIC POLICY

- Activity Six examines the role of policy makers in establishing and implementing environmental policies that protect and/or restore biodiversity, while mediating conflicting public and private interests

One of the greatest challenges of protecting biodiversity is the need to develop coherent and effective policies that can be carried out or enforced by government institutions. The making of public policies is never easy, because there are always contending points of view and interests about the appropriate role of government and the types of policies that governments should enforce. In the area of biodiversity this is certainly the case, as governments must contend with an array of interests, the divisions between government agencies about who is responsible for particular policies, and the lack of clear research information about long-term environmental trends.

In recent years, the world's forests have been the focus of many volatile public debates as policy makers struggled to create agreements at the local, regional, and international levels that both acknowledged the diverse benefits of forests and the costs of their continuing loss. In spite of the difficulty in crafting these agreements, there has been a significant effort to analyze forest issues and draw various sectors of each community together to create sound policy.

Although much of the public attention on forest issues has been focused on tropical forests in countries like Brazil and Indonesia, the United States remains one of the most extensively forested countries in the world with approximately 32% of its land now covered by forest. Many of these forests have been cleared or altered in the past. Outside of Alaska, primary forest land has been reduced to less than 5% of its original cover. Remaining old growth forests continue to be threatened by exotic pests and diseases and some commercial logging practices.

Some states have passed laws to better protect forest resources on state and public land and the U.S. Forest Service and Bureau of Land Management have developed a "ecosystem-management" policy. Nevertheless, most believe that policies that support sound forest management and the preservation of the forests' biodiversity remain piecemeal, politically contentious, and hindered by basic structures.

Outline of Activity

Students investigate several political cartoons that outline some of the policy issues faced by governments addressing the preservation of the world's forests. They also examine an organizational chart from one country's Ministry of Forestry. As a group, they then develop a flow chart that shows a process for reaching agreement on forest issues in North America.

Extension Questions

- How is public policy created? What role do individual citizens like you play in creating policy?
- Are policies created the same way in all countries?
- When a country seeks to protect its forests, which voices should be the most important in defining its policies?
- What are some of the obstacles to government policy-making and the implementation of government policies?
- In the protection of old forests, such as those in the northwest United States, what should be the main priorities for policy makers?

Related Issues

- International Treaties and Conventions
- Environmental regulation
- Regulatory agencies
- Democratic decision-making
- Jobs vs. environment

Reference Materials

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PUBLIC POLICY ACTIVITY CARD

Countries may develop domestic laws and policies and enter into treaties with other countries in order to attempt to protect and restore biodiverse resources. The process of developing and implementing these policies raises many issues and is often very controversial. There may be many different interest groups with many different ideas about what is important. The decision-making processes and bureaucratic structures of many governments may affect the implementation of policies.

Considerable attention has been given in recent years to the protection of forest resources throughout the world. The news media has given particular attention to the destruction of many of the world's tropical rainforests, such as those in Brazil and Indonesia, as environmental protection and economic development come into conflict. Equally controversial has been the conflict between the logging industry in the northwest region of the United States and those seeking to preserve remaining old growth forests. Although many areas where old growth forests once stood have been replanted, they have not been restored to a state in which their original biodiversity has been restored.

A policy is a plan or course or action selected from among alternatives in light of a certain set of circumstances. It is used by governments or other management agencies to guide its present and future decision-making. Policies are different than laws in that they do not have the same legal enforcement provisions. Policies, however, may help determine what laws need to be passed.

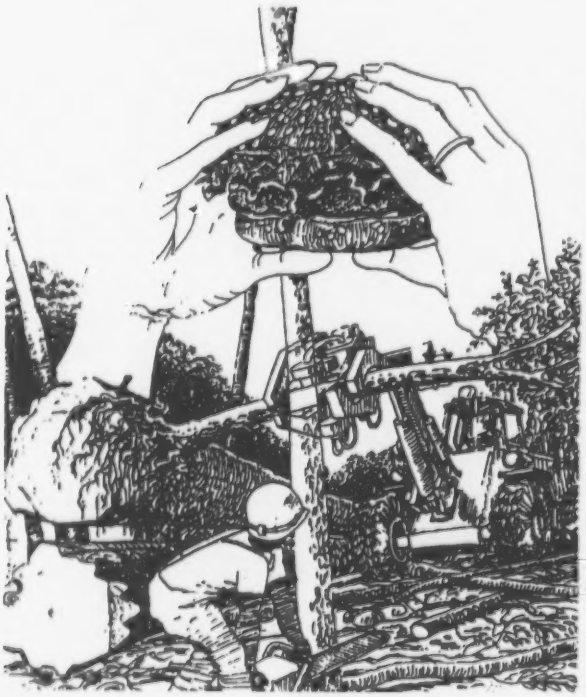
As a group, read the *Resource Card* and discuss the questions below:

1. What are some of the issues policy makers need to address in creating policy that protects forest resources?
2. How should policy makers set priorities when there are many important interests that need attention?
3. How do priorities change when long-term needs are considered?
4. How does the way a government is organized affect its ability to create and implement policies?

GROUP TASK

You are a group of government officials faced with the task of creating an effective, fair policy for the protection and management of old growth forests in the northwest United States. As a group, design a flow chart that shows the decision-making process you would use for establishing an overall policy for protecting and managing these forests. Be sure to include the different voices that you believe should be involved in the decision and to identify some of the key issues that will need to be decided.

PUBLIC POLICY
RESOURCE CARD (1 OF 2)



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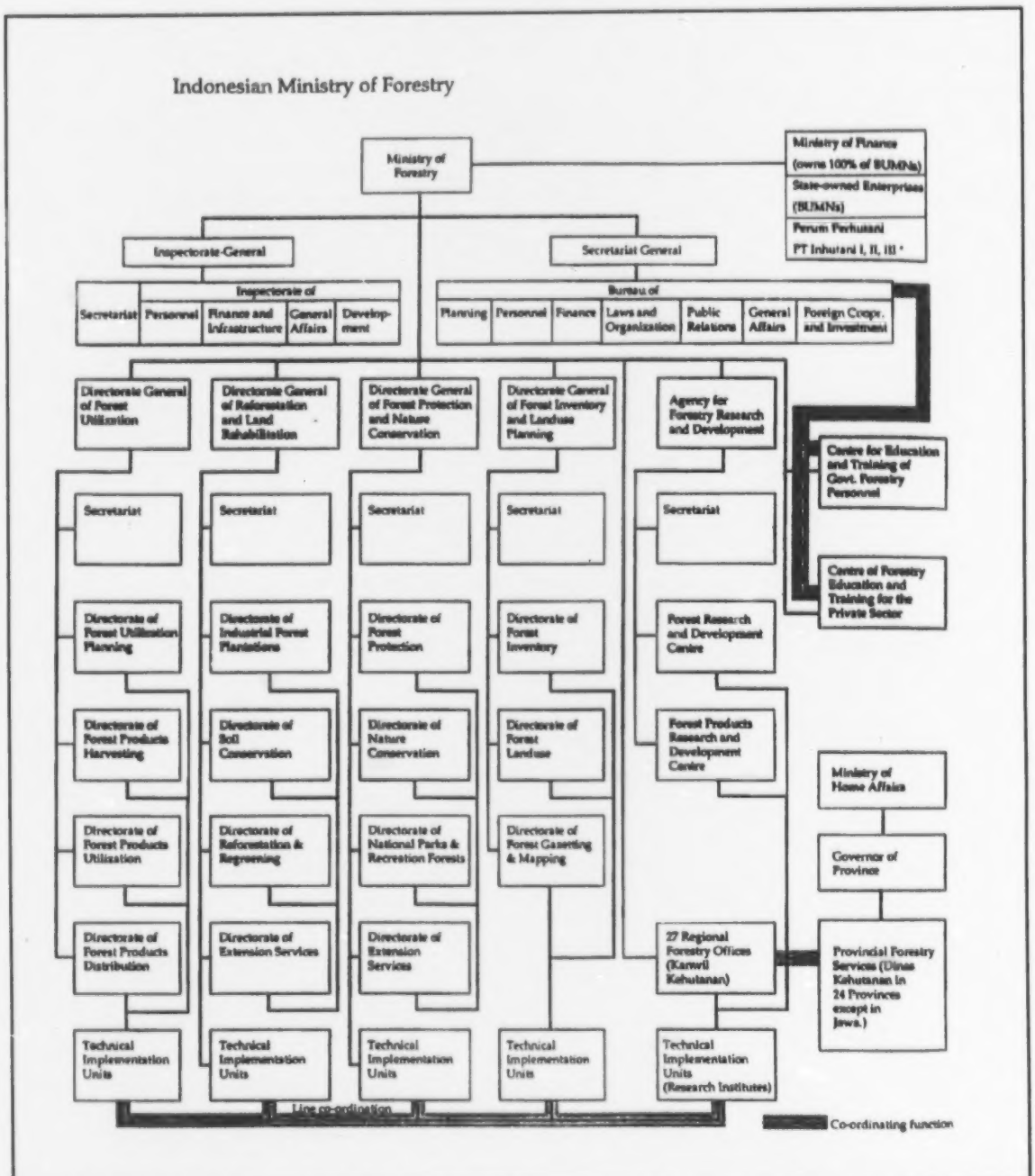
PUBLIC POLICY
RESOURCE CARD (2 OF 2)


Indonesian Ministry of Forestry
Ministry of Forestry
Ministry of Finance (owns 100% of BUMNs)
State-owned Enterprises (BUMNs)
Perum Perhutani
PT Inhutani I, II, III
Inspectorate-General
Secretariat General
Inspectorate of
Secretariat
Personnel
Finance and Infrastructure
General Affairs
Development
Bureau of
Planning
Personnel
Finance
Laws and Organization
Public Relations
General Affairs
Foreign Coops. and Investment
Directorate General of Forest Utilization
Directorate General of Reforestation and Land Rehabilitation
Directorate General of Forest Protection and Nature Conservation
Directorate General of Forest Inventory and Landuse Planning
Agency for Forestry Research and Development
Centre for Education and Training of Govt. Forestry Personnel
Centre of Forestry Education and Training for the Private Sector
Secretariat
Directorate of Forest Utilization Planning
Directorate of Forest Products Harvesting
Directorate of Forest Products Utilization
Directorate of Forest Products Distribution
Directorate of Industrial Forest Plantations
Directorate of Soil Conservation
Directorate of Reforestation & Regreening
Directorate of Extension Services
Directorate of Forest Protection
Directorate of Nature Conservation
Directorate of National Parks & Recreation Forests
Directorate of Extension Services
Directorate of Forest Inventory
Directorate of Forest Landuse
Directorate of Forest Gazetting & Mapping
Forest Research and Development Centre
Forest Products Research and Development Centre
27 Regional Forestry Offices (Kanwil Kehutanan)
Technical Implementation Units
Technical Implementation Units (Research Institutes)
Ministry of Home Affairs
Governor of Province
Provincial Forestry Services (Dinas Kehutanan in 24 Provinces except in Jawa.)
Line co-ordination
Co-ordinating function

From Barber, Charles Victor, Nels C. Johnson, and Emmy Hafild. *Breaking the Logjam: Obstacles to Forest Policy Reform in the United States and Indonesia*. World Resources Institute. New York: Oxford Press, 1994.

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PUBLIC POLICY
INDIVIDUAL REPORT

Name:_____

What role in preserving biodiversity can policies and treaties play?

Closure Activity

DEVELOPING A PLAN FOR PRESERVING BIODIVERSITY IN OUR NEIGHBORHOOD

Overview

Students will have the opportunity to survey the biodiversity of their schoolyard or neighborhood and to review the natural history of the region to determine what biodiversity may have existed there in earlier times. They will assess some of the threats to that biodiversity and some of its potential benefits. They will then develop a plan to preserve and/or restore the biodiversity of the area.

Time

Minimum of Two class periods

Materials

- Handout 7: *Environmental Scientists: Collecting Baseline Biodiversity Data* (1 per group)

Suggested Procedure

1. Initiate a discussion with the class about the biodiversity of the area around the school. Ask the students to list some of the organisms that exist in the area. Conduct a brief discussion of the potential value of some of the biodiverse resources.

2. Determine an area for the students to survey. Depending on access and safety issues, you may wish to restrict this activity to the schoolyard itself or extend it to the neighborhood or larger community.

3. Tell the students that over the next few days they will first assume the role of scientists conducting research on biodiversity and then assume the role of policy makers establishing a plan for preserving biodiversity.

   Tell the students that an important activity for scientists is to gather what is called "baseline" data that measures the kind and number of organisms that exist in an area. Data may also be collected about the threats to the existence of these organisms. This data allows both scientists and policy makers to measure the amount and rate of loss of biodiversity and to better assess the effectiveness of strategies of preserving biodiversity.

4. Distribute Handouts 7 to each group. Ask them to collect data that will help them create an effective policy for preserving and/or restoring biodiversity in the area. If time allows, you may want to give the students several days for this part of the activity. Bring the class together for the last 10 minutes of each research day to debrief the days activities and deal with evolving questions.

closure activity

5. When the data collection process is complete, ask each group to assume the role of policy-makers and develop and present a plan for preserving and/or restoring the biodiversity of the area selected.

6. Debrief the presentations by asking some of the following questions:

- In what ways can scientific information help policy makers create better policy?
- What are some of the difficulties faced by scientists in collecting information about the biodiversity of an area?
- What are some of the difficulties faced by policy-makers in using scientific information in setting policy?
- What else do policy-makers need to know in order to make good decisions?

7. Following the group presentations, ask each student to write a letter to someone who will be 15 years old in 2050, perhaps a future grandchild. The letter should reflect the student's personal views about the importance of biodiversity to the world's people and his/her ideas about how best to protect these resources.

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ENVIRONMENTAL SCIENTISTS: COLLECTING BASELINE BIODIVERSITY DATA

You are to act as a group of scientists collecting information about the biodiversity of the area you and your teacher have selected. It is your job to determine the following:

- What forms of biodiversity currently exist in the area?

- How many are there of each organism? (You may need to use sampling techniques to determine this—count the organisms in a small area and then multiply that number by a number that estimates the relationship between the whole area and your sample. Some scientists find it useful to create a frame that is one foot square and use it to help count organisms in a particular area.)

- What importance, now or in the future, does each organism have?

- How is each organism related to other organisms in the area?

- What threats to these organisms exist (real or potential)?

- What organisms existed in the area in the past that do not live there now? (Hint: you may want to check with a local environmental group or with a local history center to determine the natural history of the community before your school was built.)

- What were some of the causes for the disappearance of these organisms?

- In what ways might it benefit the area if some of these biodiverse resources were restored?

As a group, you may want to create a standardized form to help you record the data you collect. You may want to divide the tasks among your group members in order to gather the most data.

APPENDICES

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appendix b

CONVENTION ON BIOLOGICAL DIVERSITY (1992)

Preamble

The Contracting Parties,

Conscious of the intrinsic value of biological diversity and of the ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic values of biological diversity and its components,

Conscious also of the importance of biological diversity for evolution and for maintaining life sustaining systems of the biosphere,

Affirming that the conservation of biological diversity is a common concern of humankind,

Reaffirming that States have sovereign rights over their own biological resources,

Reaffirming also that States are responsible for conserving their biological diversity and for using their biological resources in a sustainable manner,

Concerned that biological diversity is being significantly reduced by certain human activities,

Aware of the general lack of information and knowledge regarding biological diversity and of the urgent need to develop scientific, technical and institutional capacities to provide the basic understanding upon which to plan and implement appropriate measures,

Noting that it is vital to anticipate, prevent and attack the causes of significant reduction or loss of biological diversity at source,

Noting also that where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize such a threat,

Noting further that the fundamental requirement for the conservation of biological diversity is the in-situ conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings,

Noting further that ex-situ measures, preferably in the country of origin, also have an important role to play,

Recognizing the close and traditional dependence of many indigenous and local communities embodying traditional lifestyles on biological resources, and the desirability of sharing equitably benefits arising from the use of traditional knowledge, innovations and practices relevant to the conservation of biological diversity and the sustainable use of its components,

Recognizing also the vital role that women play in the conservation and sustainable use of biological diversity and affirming the need for the full participation of women at all levels of policy-making and implementation for biological diversity conservation,

Stressing the importance of, and the need to promote, international, regional and global cooperation among States and intergovernmental organizations and the non-governmental sector for the conservation of biological diversity and the sustainable use of its components,

Acknowledging that the provision of new and additional financial resources and appropriate access to relevant technologies can be expected to make a substantial difference in the world's ability to address the loss of biological diversity,

Acknowledging further that special provision is required to meet the needs of developing countries, including the provision of new and additional financial resources and appropriate access to relevant technologies,

Noting in this regard the special conditions of the least developed countries and small island States,

Acknowledging that substantial investments are required to conserve biological diversity and that there is the expectation of a broad range of environmental, economic and social benefits from those investments,

Recognizing that economic and social development and poverty eradication are the first and overriding priorities of developing countries,

Aware that conservation and sustainable use of biological diversity is of critical importance for meeting the food, health and other needs of the growing world population, for which purpose access to and sharing of both genetic resources and technologies are essential,

Noting that, ultimately, the conservation and sustainable use of biological diversity will strengthen friendly relations among States and contribute to peace for humankind,

Desiring to enhance and complement existing international arrangements for the conservation of biological diversity and sustainable use of its components, and

Determined to conserve and sustainably use biological diversity for the benefit of present and future generations,

Have agreed as follows:

Article 1. Objectives

The objectives of this Convention, to be pursued in accordance with its relevant provisions, are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding.

Article 2. Use of Terms

For the purposes of this Convention:

"Biological diversity" means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

"Biological resources" includes genetic resources, organisms or parts thereof, populations, or any other biotic component of ecosystems with actual or potential use or value for humanity.

appendix b

"Biotechnology" means any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use.

"Country of origin of genetic resources" means the country which possesses those genetic resources in in-situ conditions.

"Country providing genetic resources" means the country supplying genetic resources collected from in-situ sources, including populations of both wild and domesticated species, or taken from ex-situ sources, which may or may not have originated in that country.

"Domesticated or cultivated species" means species in which the evolutionary process has been influenced by humans to meet their needs.

"Ecosystem" means a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.

"Ex-situ conservation" means the conservation of components of biological diversity outside their natural habitats.

"Genetic material" means any material of plant, animal, microbial or other origin containing functional units of heredity.

"Genetic resources" means genetic material of actual or potential value.

"Habitat" means the place or type of site where an organism or population naturally occurs.

"In-situ conditions" means conditions where genetic resources exist within ecosystems and natural habitats, and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties.

"In-situ conservation" means the conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties.

"Protected area" means a geographically defined area which is designated or regulated and managed to achieve specific conservation objectives.

"Regional economic integration organization" means an organization constituted by sovereign States of a given region, to which its member States have transferred competence in respect of matters governed by this Convention and which has been duly authorized, in accordance with its internal procedures, to sign, ratify, accept, approve or accede to it.

"Sustainable use" means the use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations.

"Technology" includes biotechnology.

Article 7. Identification and Monitoring

Each Contracting Party shall, as far as possible and as appropriate, in particular for the purposes of Articles 8 to 10:

(a) Identify components of biological diversity important for its conservation and sustainable use having regard to the indicative list of categories set down in Annex I;

(b) Monitor, through sampling and other techniques, the components of biological diversity identified pursuant to subparagraph (a) above, paying particular attention to those requiring urgent conservation measures and those which offer the greatest potential for sustainable use;

(c) Identify processes and categories of activities which have or are likely to have significant adverse impacts on the conservation and sustainable use of biological diversity, and monitor their effects through sampling and other techniques; and

(d) Maintain and organize, by any mechanism data, derived from identification and monitoring activities pursuant to subparagraphs (a), (b) and (c) above.

Article 8. In-situ Conservation

Each Contracting Party shall, as far as possible and as appropriate:

(a) Establish a system of protected areas or areas where special measures need to be taken to conserve biological diversity;

(b) Develop, where necessary, guidelines for the selection, establishment and management of protected areas or areas where special measures need to be taken to conserve biological diversity;

(c) Regulate or manage biological resources important for the conservation of biological diversity whether within or outside protected areas, with a view to ensuring their conservation and sustainable use;

(d) Promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings;

(e) Promote environmentally sound and sustainable development in areas adjacent to protected areas with a view to furthering protection of these areas;

(f) Rehabilitate and restore degraded ecosystems and promote the recovery of threatened species, inter alia, through the development and implementation of plans or other management strategies;

(g) Establish or maintain means to regulate, manage or control the risks associated with the use and release of living modified organisms resulting from biotechnology which are likely to have adverse environmental impacts that could affect the conservation and sustainable use of biological diversity, taking also into account the risks to human health;

(h) Prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species;

(i) Endeavour to provide the conditions needed for compatibility between present uses and the conservation of biological diversity and the sustainable use of its components;

(j) Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices

and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices;

(k) Develop or maintain necessary legislation and/or other regulatory provisions for the protection of threatened species and populations;

(l) Where a significant adverse effect on biological diversity has been determined pursuant to Article 7, regulate or manage the relevant processes and categories of activities; and

(m) Cooperate in providing financial and other support for in-situ conservation outlined in subparagraphs (a) to (l) above, particularly to developing countries.

Article 15. Access to Genetic Resources

1. Recognizing the sovereign rights of States over their natural resources, the authority to determine access to genetic resources rests with the national governments and is subject to national legislation.

2. Each Contracting Party shall endeavour to create conditions to facilitate access to genetic resources for environmentally sound uses by other Contracting Parties and not to impose restrictions that run counter to the objectives of this Convention.

3. For the purpose of this Convention, the genetic resources being provided by a Contracting Party, as referred to in this Article and Articles 16 and 19, are only those that are provided by Contracting Parties that are countries of origin of such resources or by the Parties that have acquired the genetic resources in accordance with this Convention.

4. Access, where granted, shall be on mutually agreed terms and subject to the provisions of this Article.

5. Access to genetic resources shall be subject to prior informed consent of the Contracting Party providing such resources, unless otherwise determined by that Party.

6. Each Contracting Party shall endeavour to develop and carry out scientific research based on genetic resources provided by other Contracting Parties with the full participation of, and where possible in, such Contracting Parties.

7. Each Contracting Party shall take legislative, administrative or policy measures, as appropriate, and in accordance with Articles 16 and 19 and, where necessary, through the financial mechanism established by Articles 20 and 21 with the aim of sharing in a fair and equitable way the results of research and development and the benefits arising from the commercial and other utilization of genetic resources with the Contracting Party providing such resources. Such sharing shall be upon mutually agreed terms.

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